MSc Construction Economics and Management

Knowledge Management in Project-Based Organizations

The Case of Attiko Metro S.A. in Thessaloniki Metro Project

by

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Abstract

The aim of this research is to explore the potentials of a major Greek project-based organization to develop competencies by exploiting the knowledge which is leveraged from the projects or the procedures which come before and follows a project. Furthermore, through the comparison with theory content, we identified the opportunities for the implementation of PBL in Attiko Metro (AM). Our research study is segmented in 6 chapters. The first one includes a brief anaphora of the KM concepts and the main objectives of our work, which is followed by the literature review (chapter 2). Here, it is being developed a theoretical framework for the upcoming analysis and it is also created solid bedrock of the main concepts that will be needed in our research. In the third chapter, the methodology that has been used is introduced and more specifically it is shortly explained the reason behind every choice that was made. The fourth chapter refers to our case study and it provides an overview of the firm and the project of the case study, as also the retrieved data review. What follows is the analysis part, where the data is related to the theory and it results complete concepts that are interpreted into conclusions and recommendations in the final chapter of the report.

Key words: Knowledge Management, Organizational Learning, Learning Organization, Thessaloniki Metro Project, Project Based Learning, Attiko Metro

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Abbreviations

AM: Attiko Metro
AUTh: Aristotle University of Thessaloniki
BoK: Body of Knowlege
CCTV: Close Circuit Television
EU: European Union
IT: Information Technology
JV: Joint Venture
KM: Knowledge Management
LO: Learning Organization
M&E: Mechanics & Electronics
OL: Organizational Learning
PBL: Project Based Learning
PBO: Project Based Organization
PFI: Private Finance Institution
SA: Sosiedad Anónema
SGKM: Second Generation Knowledge Management
SME: Subject Matter Expert
TBM: Tunnel Boring Machine
TMP: Thessaloniki Metro Project
UK: United Kingdom

Introduction

1.1 Identification of the Problem and the Problem 'owner'

Knowledge nowadays is a concept that we meet almost everywhere, in every aspect of life there is specialized knowledge and the possession of it is recognized as an advantage. Actually, the importance of knowledge is not something new, but in our times, people proceed to extended codification of knowledge (creation of BoKs almost for every subject) and they moved one step beyond by trying to transform knowledge into something measurable which would be able to be stored, transferred and purchased almost as it happens with goods.

Managers always scout for new disciplines and managerial tools that would give them a strategic advantage against the competition. So, it is no surprise the identification of knowledge management (KM) as a continually upcoming trend in every type of industry or organization.

Generally, the initial thoughts about KM practices keep pace with the introduction of new technologies and IT systems which would help the gathering, storing and diffusion of knowledge. After a period of time has passed, those practices which provide exclusively explicit type of knowledge are regarded as deficient and the need for retrieving knowledge through personal contact arises. Arian Ward (cited in Collison and Parcell, 2001) says: *'it is not about creating an encyclopedia that captures everything that anybody ever knew. Rather, it is about keeping track of*

those who know the recipe and nurturing the culture and the technology that will go them talking.' Initial beliefs about KM were developed further and new concepts were created, OL and LO are the most well-known. As the debate about KM was still going on, project based organizations (PBOs) developed the concept of Project-based Learning. *Project organizations are a privileged place for learning, as there is a need for combining creative and exploitative learning to manage projects efficiently and effectively.* (Bredillet, 2004) PBL is a very interesting concept also for this study as the case study is on a PBO. Organizations that had applied PBL can achieve better management of projects which is the key for bigger business success. The successful implementation of these disciplines cannot be indicated by guidelines and no matter how many *good practices* have been identified, there are no laws for PBO (Morris, 2004) as the projects are aspects of vastly variety.

The phenomenal simplicity of the concept can easily mislead to inadequate activity by the side of the organization and result failure. The strongly 'customized' character of good practices in KM and its need for *holistic* approach (Collison and Parcel, 2001) are being forgotten quite often from the managers who rush to adopt fresh managerial disciplines without identifying their core 'ideology'.

1.2 Research Objectives

The present thesis follows a qualitative methodology to deal with the implementation of knowledge management practices in AM during its engagement with the Thessaloniki Metro Project (TMP). The focus is on revealing the ways that the organization is taking lessons through the knowledge which is generated in the projects and how it utilizes the gained lessons to future projects. My research aims to answer on the following questions:

1. In which extend do they use KM?
2. Which KM and OL practices do they use?
   Search and analyze which practices they use. What kind of knowledge they manipulate by these practices.
3. What do they succeed?
   Benefits they gain from implementation of KM both in a technical level as also in a managerial one

1.3 Value of the Research

This paper presents the results of a case study conducted in a large Greek organization which participates in the construction of big projects, the major aim being to identify how it has developed a KM initiative and system. Hopefully, the information extracted from this study will be beneficial to other organisations that are attempting to implement KM or to those that are unfavorable of adopting it. Moreover, the secondary aim is to evaluate qualitatively how the organization is building competitive advantage in terms of technical superiority and managerial maturity.

1.4 Limitation of the Study

Firstly, because of the fact that the project is still in very early stage, the existent data is limited. However, the examples which were found and they are included in the report had covered the main needs of the present thesis. In addition to this, we used a fairly small sample of answered questionnaires for the evaluation of some practices and we did not extend our data research in matters of organizational culture etc. For both weaknesses of the report, the answer lies in the restriction of time and text length.

Chapter 2

Literature Review

Not referenced

2.1 Introduction

The importance of knowledge was highlighted from the ancient times; Socrates said *'There is only one good, knowledge, and one evil, ignorance'* (Laertius, early 3rd century[A.D.]; Hicks, 1942), but still, a long period of time passed until we started to manipulate knowledge as a technocratic tool; beyond the common belief that it is exclusively a kind of mental wealth. Of course, knowledge never stops to grow through a mental - mainly – process, but in our times, the era of informatics, we are trying to 'push' this process with the help of numerous technicalities.

It is a matter of few years time that people started to organise specific ways of acquiring, codifying, storing, transferring and utilizing knowledge - in terms of management - in order to gain benefits in an enterprise-wide environment. This organised 'treatment' of knowledge within organizations led to what we refer today as *Knowledge Management* (KM) and *Organisational Learning* (OL). Although today there is a great number of authors who work on KM or OL and enrich the content of those concepts, it was Polanyi in 1966 who first *presented knowledge as something that can have intrinsic value placed on it* (Bredillet, 2004) and he took one step further by identifying different types of knowledge (explicit v tacit).

Referring to OL, although that it shares many common characteristics with KM – actually they are two interconnected issues – the first relevant text studies did not

come from Polanyi, but from Argyris and Schön (1978) who also proposed a definition for it and described some of its main elements. As KM and OL are still new and upcoming management tools, it is not surprising that their content is not completely agreed upon and the boundaries between them are blurred. This is the reason for the broad anaphora to different authors and different approaches that follows.

Analytically, in this chapter we shall discuss about KM; what is KM and which types of knowledge we recognise; how we utilize knowledge and which KM practices we are putting in place in order to accomplish that; finally, we will highlight the benefits and difficulties of KM implementation in an organisation. Continuing with the definition and meaning of OL, we will refer to some examples of learning in real organisations in order to illustrate its role and then proceed to project based learning (PBL) which has an additional connection with the construction industry as it is a project based industry. Next, we will try to underline the differences between KM and OL in order to clarify as much as possible their discernible roles in an organisation. Finally, we introduce the concept of the Learning Organisation (LO) and its impact in the way that firms work today.

2.2 Knowledge Management

Knowledge Management is a process that helps organisations find, select, organise, disseminate and transfer important information and expertise necessary for activities such as problem solving, dynamic learning, strategic planning and decision making (Gupta et al 2000). As a managerial discipline, it is up to the people of every organisation to decide how they will apply its practices on their own working environment.

Over the years of KM usage a number of useful concepts have been documented, which help us to understand issues about knowledge in organisations and also organise the aforementioned practices.

The first and probably the most common concept is that of the discrimination between tacit and explicit knowledge. Polanyi (1958) was the very first who made a clear distinction between tacit and implicit knowledge, but since then a long debate has been running in the KM movement with Nonaka's work possibly being the most

influential of all. Nonaka in 1995 followed Polanyi and he suggested the existence of two types of knowledge, one that can be easily codified and documented (explicit knowledge) and one that is exclusively embedded in the human brain and cannot be easily transferred (tacit knowledge).

A concept strongly related to the one above is that of codification and personalization (Hansen, 1999) referring to *organization's primary approach to knowledge transfer* (Bredillet, 2004). Codification is in use when an organisation decides to transfer knowledge in the form of documents and other 'products' of explicit knowledge when, on the contrary, personalization is related to the decision of an organisation to transfer knowledge through its people. Actually, the same concept was suggested also by Hildreth et al 1999, but under the name of soft and hard knowledge.

Boisot in 1998 proposed the concept of knowledge assets as the result of a process which include the creation and application of knowledge. Boisot distinguishes knowledge in terms of codification (codified/uncodified), abstraction (abstract/ concrete) and diffusion (diffused/undiffused).

Finally, one of the most influential concepts is 'communities of practice' which originates from the study on OL. Wenger (1998) states that knowledge flows better through networks of people who may not share the same job in an organisation, but they share the same targets for the organisation. For that reason, he suggests that organisations '*must learn to manage themselves as social learning systems and develop such systems internally...or...participate in broader learning systems in which they are only one of many players*' (Wenger, 2000).

Everything that has been mentioned above describes the theoretical framework of KM, but the most important part for a manager is the practical one. A manager is concerned with 'how KM applies in organisations'. That happens mainly through KM practices. There are a great number of them depending on the type of organisation we refer to or the means and resources that managers have in their hands. Although these practices are specialised for every given organisation, their common approaches towards the same end, help us to group them and generalize some proposals.

Firstly, technology and internet are exploited in order to be accomplished the gathering, codification and storage of knowledge. Companies create extended networks of computers in the form of intranets, extranets or e-libraries where they try

to gather all the useful knowledge that incomes or is created within the company. Most of the firms invite their people to 'feed' their system with reports, documents etc of specific situations they confronted in order to create a database which will be accessible - in future time - to employees of the firm in order to enquire information. When the usage of electronic databases ends at that point, there is a significant danger that the system will not to return the expected benefits. *Simply collecting 'lessons learned' and putting these into some kind of database for future reference is not enough* (Morris and Loch, 2004). By these means it is more possible to accomplish a kind of 'information management' than KM.

A very good use of IT systems is 'good practices' in Ford in order to succeed the 'task', a 5% annually increase in productivity (Dixon, 1994). Ford's employees from different plants put in the intranet of the firm the 'best practices' they discover, accompanied with comments about the necessary resources and practice's final outcome. Later, they also started using pictures and short videos in order to support their reports. Although that this kind of usage brings good results it is still inappropriate to deal with tacit knowledge.

As tacit knowledge cannot be easily transferred through documents or other technical channels, organisations try to find ways to bring people together in order to exchange experience and knowledge. Companies organise regular meetings in the working environment or encourage visits to distant departments of the organisations so as to succeed the aforementioned scope. There is also the concept of 'Subject Matter Experts'; they are key-persons who held some special knowledge about specific matters - for which they are considered gurus - and the rest employees address to them for any inquiry around these subjects. Finally, some organisations try to create the environment or culture which will nurture personal contacts and knowledge transfer among employees. For example the redesign of the work place; the removal of the box-desks and the ability of eye-contact among employees plus the installation of wireless devices (e.g. telephones etc) in the firm, improve people's mobility and encourage personal contacts.

Dixon (1994) suggests the categorisation of KM practices according to the type of knowledge we transfer; specifically she defines five categories:

- Serial Transfer: when a team leverage knowledge from the project A and then transfer and reuse this knowledge in project B, where project A ≠ project B

- Near Transfer: when a team which possesses knowledge that was gained from a project A transfer it to another team which works in a similar project
- Far Transfer: when takes place a transfer of tacit knowledge from somebody with specialised and critical knowledge about a subject
- Strategic Transfer: similar to far transfer, but for more complicated knowledge which relates to more than 1 unit or 1 subject.
- Expert Transfer: when there is transfer of explicit knowledge about a much specialised issue.

Sir Francis Bacon in 1597 had declared that *'knowledge is power'* and since then no matter how many things have changed, knowledge have kept its value. It is *considered a source of competitive advantage* (Morris and Loch, 2004) for the companies of developed economies against the competencies that appear in developing economies' firms (e.g. low cost labour). This advantage can break down and be analyzed in a series of benefits. Collison and Parcel (2001) suggest the following:

- Delivering more from less
- Improving identification and transfer of good practices
- Learning and improving leading to faster cycle times in product development and continuous improvement
- Preventing the repetition of mistakes, and wheel-reinvention
- Identifying and overcome a not invented here culture
- Improving the level of sharing and take-up of new ways of working

Unfortunately, the application of KM has disadvantages as well. First of all, it needs resources. It needs people commissioned with the supervising and design of the KM techniques in the company, it needs also time to put things in place until it starts working properly and of course it need funds. It is very much a matter of leadership and corporate strategy. It requires a willingness to deal with the underlying culture and process issues – it's not just a technology quick fix – it's a holistic approach (Collison and Parcel, 2001). In support of Colison's and Parcel's opinion we must add that the relevant benefits appear quite a long period of time later. Moreover, it is mainly applicable to big organisations although that there are benefits even for smaller firms. Last but not least, many times the limitations originate from the deceptive simplicity of the discipline or even from the inability of IT software technicians or programmers to understand and deliver the necessary software.

2.3 Organizational Learning

Organizational Learning (OL) is closely related at KM and the theory of the one intersects the one of other's. Because of the nature of learning, there are many controversial definitions for OL according to each author's point of view. Chris Argyris and Donald Schön (1978) defined OL as *'the detection and correction of error'*. Fiol and Lyles later defined learning as *'the process of improving actions through better knowledge and understanding'* and they introduced 'higher' and 'lower' level of learning. Finally, Dodgson (1993) describes OL as *'the way firms build, supplement, and organize knowledge and routines around their activities and within their cultures and adapt and develop organizational efficiency by improving the use of the broad skills of their workforce'.*

OL is not defined so technically as KM and has more space to fit its practices in. On the other hand, because of our need for better understanding and the managerial need for easier 'application', we recognise different types of learning. Argyris and Schön – again - described three types of OL:

- *Single-loop learning*: this occurs when errors are detected and corrected and firms continue with their present policies and goals. According to Dodgson (1993), single-loop learning can be equated to activities that add to the knowledge-base or firm-specific competences or routines without altering the fundamental nature of the organization's activities.
- *Double-loop learning*: this occurs when, in addition to detection and correction of errors, the organization questions and modifies its existing norms, procedures, policies and objectives. Double-loop learning involves changing the organization's knowledge – base or firm – specific competencies or routines (Dodgson, 1993)
- *Deutero- learning*: this occurs when organizations learn how to carry out single-loop learning and double-loop learning. The first two forms of learning must occur. Being aware of ignorance motivates learning (Nevis et al, 1995).

One of the most interesting concepts in management today is Project-Based Learning (PBL). Morris (2004) wrote: *'our challenge is to understand how to develop and deliver them* (projects) *more effectively, not merely to deliver projects on time, in*

budget, to scope' and the answer to that challenge is PBL. So, how can we work for PBL? If we follow Morris' point (2004) that *'knowledge creation and dissemination are the bases of real OL in project – based organisations',* then, we have to apply practices that create knowledge.

Nonaka and Takeuchi (1995) propose a model of the K creating process to understand the dynamic nature of knowledge creation and to manage such a process effectively, the SECI model, where S stands for socialization, E for externalization, C for combination and I for internalization. The process that Nonaka proposes is explained clearly at the matrix below.

From /To	**Tacit**	**Explicit**
Tacit	*Socialisation* Creates *sympathised* knowledge through the sharing of experiences, and the development of mental models and technical skills. Language unnecessary.	*Externalisation* Creates *conceptual* knowledge through knowledge articulation using language. Dialogue and collective reflection needed.
Explicit	*Internalisation* Creates *operational* knowledge through learning by doing. Explicit knowledge like manuals or verbal stories helpful.	*Combination* Creates systemic knowledge through the systemising of ideas. May involve many media, and can lead to new knowledge through adding, combining & categorising.

Table 2.1: matrix that depicts the SECI model [Nonaka and Takeuchi, 1995]

Actually, there are many relevant proposals from other authors for successful PBL practices, where each of them focuses on different characteristics of learning. In the table below (cited in Morris and Loch 2002) there are concentrated most of these practices.

- Systematic collection of learning [on projects]
- Clarity of project development process
- Periodic project review points
    - Post – project evaluation
- Distinguishing between tacit and explicit knowledge
- Identification of key persons as repositories of tacit knowledge and as 'owners' of subject matter areas:
    - Subject Matter Experts
    - Coaches
    - Mentors
- Information management tools to capture, store, process, archive, retrieve and present explicit knowledge
- A discipline of accessing knowledge (using checklists or other 'look up' guides etc) by the project teams before beginning a new project task
- A definition, in some way, of the knowledge in a particular area: the 'Body of Knowledge'
- Establishment of an integrated KM program in place [informally even if not formally]
- Formal management of this KM program
    - A KM manager
    - Career path
- A formal program of learning defined, using this knowledge
- The distinction made between individual, team and organizational learning
- A mechanism for updating the knowledge. How frequently are old, outdated paradigms / bits of knowledge discarded?
- A program or programs developed to use the knowledge / learning that is 'identified', for example in:
- Metrics/ benchmarking
- Continuous improvement
- Training
- Competency development
    - Individual
    - Organizational

Table 2.2: Best practices in PBL [Source: adapted from Morris and Loch, 2004]

Last but not least, it must be mentioned the study of Scarbrough, Swan, Laurent, Bresnen, Edelman and Newell (2003) about the volume in which organizations can learn from projects just by focusing on the relationship between projects and their organizational context. They highlight three dimensions of project-based learning: the practice-based nature of learning, project autonomy and knowledge integration. Next they underline the 'learning boundaries' which emerge when learning within projects creates new divisions in practice and finally they find out that learning boundaries are an important constraint on attempts to exploit the benefits of project based learning for the wider organization.

2.4 KM v OL

Knowledge Management and Organisation Learning are two close managerial disciplines with very thin boundary lines between them. In our effort to clarify their differences and how they cooperate we will present many approaches from various authors. For Terra and Angeloni *'KM practice has distanced itself from the OL field, it is possible to argue that from a theoretical point of view, the KM discipline can also be seen as a direct inheritor of OL field. Thus, knowledge can be seen as a "stock" and learning as the "flow" of knowledge.* McElroy from IBM said that *'SGKM* (Second Generation KM[1]) *is an implementation strategy for organizational learning'* (1999).

Easterby and Lyles (2003) placed OL and KM in a matrix where they focused on their differences according to the process and content. The graphs and the table that was finally generated are below.

	Process	Content
Knowledge	"Awareness or familiarity gained by experience of a fact or situation"	"Facts, information, and skills acquired through experience and education"
Learning	"The acquisition of knowledge or skills through study, experience or being taught"	"Knowledge acquired in this way"

Table 2.3: Comparison of OL & KM [Source: adapted from Easterby Smith and Lyles, 2003]

[1] *Unlike first-generation KM, in which technology always seems to provide the answer, second-generation thinking is more inclusive of human resource and process initiatives.*(McElroy, 1999)

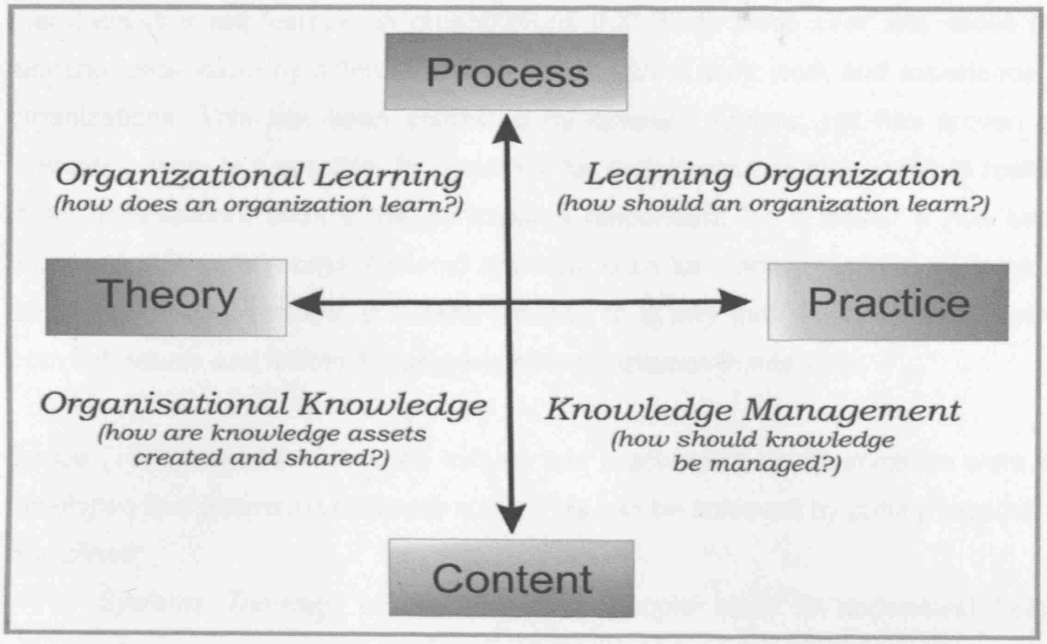


Figure 2.1: Knowledge matrix [Source: adapted from Easterby Smith and Lyles, 2003]

> KM is concerned largely with the way knowledge is acquired, classified, stored, retrieved and communicated. Arising largely out of IT, and still having much of IT about it, it has increasingly been also focussing on business impact [Davenport & Prusak, 1998; Scarbrough, Swan & Preston, 1999]. OL focuses on how organisations as such can best learn, so that the knowledge they possess is effectively used and performance improved. OL stems, largely, from the organisational theory literature [Simon, 1957].
>
> (Morris and Loche, 2002)

It is like KM being the preparation for OL or maybe the first step towards OL and then to learning organisation (LO). If OL is the destination of our managerial efforts, then KM is the way.

2.5 Learning Organization

Garvin (2000) defined Learning Organization (LO) as *an organization skilled at creating, acquiring, interpreting, transferring and retaining knowledge and at purposefully modifying its behaviour to reflect new knowledge and insights.*

Both KM practices and OL practices help and are helped in a LO, actually KM and OL are linked in a systemic way through action and the quest of developing LO (Bredillet in Morris and Pinto, 2004). The idea of a learning organization suggests

that there is some learning in organizations that takes place over and above the learning undertaken by different individuals as part of their work and experience in organizations. This has been contested by different authors, but has proven an interesting idea. Is it possible, for example, for certain aspects of learning to remain in an organization, even if the participants responsible for it leave? It has been proposed that certain organizational artifacts, such as stories, records, systems of doing work, tools, recipes, et cetera, function in a way that detaches the learning from individuals and makes it a property of organizations themselves.

Senge (1993) advocated that the culture and practices of an organization were so developed that enterprise becomes a LO. This can be achieved by putting together 5 disciplines:

1. *Systems Thinking*: In this discipline, people learn to understand better interdependency and change, and thereby to deal more effectively with the forces that shape the consequences of our actions. Systems' thinking is based upon a growing body of theory about the behaviour of feedback and complexity.
2. *Shared Vision*: This collective discipline establishes a focus on mutual purpose. People learn to nourish a sense of commitment in a group or organization by developing shared images of the future they seek to create, and the principles and guiding practices by which they hope to get there.
3. *Challenging Mental Models*: his discipline of reflection and inquiry skills is focused around developing awareness of the attitudes and perceptions that influence thought and interaction. By continually reflecting upon, talking about, and reconsidering these internal pictures of the world, people can gain more capability in governing their actions and decisions.
4. *Team Learning*: This is a discipline of group interaction. Through techniques ialogue and skilful discussion, teams transform their collective thinking, learning to mobilize their energies and ability greater than the sum of individual members' talents.
5. *Personal Mastery*: This discipline of aspiration involves formulating a coherent picture of the results people most desire to gain as individuals (their personal vision), alongside a realistic assessment of the current state of their lives today (their current reality).

Summary So what?

Methodology Research

3.1 Scope of Study

The scope of the present report is to study the application of KM practices in AM during its involvement in TMP as one of the project's key player. Specifically, the study has narrowed down to focus on the creation of knowledge within AM and the transfer of knowledge from one project to another (mainly between the two Greek metro projects). The initial aim of the report is to explore in which grade a highly regarded managerial discipline (KM) applies in one of the biggest project based organizations of Greece and by which means is that taking place.

3.2 Methodological Approach

The present thesis follows a qualitative research method as the extension and complexity of the problem is not allowing us to proceed in quantitative analysis. The data we used to cover our research was a mix of practical attributes about systems which are in place, fixed procedures within company, chosen practices with non measurable and hard-to-document information (a kind of tacit data), for example issues relevant to the culture of the organization or the commitment of leadership to a scope. That fact led us to choose a methodology which combined data retrieval on

request, questionnaires and a semi-structured interview. Actually, our methodology was being built during the procedure of our work and it was designed in a way to provide us information which would help us to prepare our next steps.

We can break this procedure in 3 parts.
Initially, after the personal research had been done and the structure of the paper had been partly clarified, a contact (via telephone) with AM was made for the gathering of the requisite information. Data's field was so extended that included from general information about AM and its engagement with TMP to description of IT systems and managerial practices. The inability of a single person to provide us with that information is totally palpable. Consequently, a list with 17 points was prepared and mailed to the organization together with short explanatory notes or hook-ups which could help with any unknown issues and partly secure the avoidance of misunderstandings. The data that was finally gathered formed AM's image and it was utilized as the raw material for our research. The rest of our research methodology was supplementary to this one and its scope was to clarify some points, analyze them in more detail or extend their content. No matter which was its role, the importance of that data was equal to the initially retrieved.

Ref Annex

The use of a short questionnaire was chosen for the acquisition of AM's people opinion about the function of systems which were described in the obtained data. The questionnaires had only 12 questions, where 11 of them were closed type. This form was selected in order to motivate employees to answer (economy of time) and give to our research specific results. The questions were designed to be simple (eliminate possible misunderstandings) and neutral (avoid the promotion of preferable answers). Finally, the use of a semi-structured interview with an engineer of AM helped the opening of a wider discussion which shed light on issues of organization culture and it adumbrated the profile of aspects which were solely technically described.
The data that was gathered by the aforementioned methodology is analyzed on the next chapters of the report. The original questionnaire, list of points that was mailed to AM and the 'guiding' questions of the interview can be found in appendix.

Case Study

4.1 Thessaloniki Metro Project

As has been mentioned before, Thessaloniki Metro Project (TMP) was chosen as the case study for the report. It is a big, modern, complex project, with different players taking part in it, so it contains many characteristics that together make it an interesting case for Project Based Learning (PBL). In order to gain a better apprehension on the analysis that follows in KM, OL, LO and PBL issues, it is essential to bear in our minds an overview of the project itself, in addition to any possible specialties of it, for example its correlation with the city and its potential users as units or even as a community.

TMP is the biggest public project that has ever been constructed in Thessaloniki and it was a long-standing request of Thessaloniki's people, as its construction was firstly – official – announced almost 15 years ago (1992) . After the first unsuccessful attempt (1998-2003) to construct Thessaloniki Metro as a PFI project, the scheme was decided to be co-funded by the Greek government and the European Union. Attiko Metro S.A., a national organization which operates under the supervision of the Ministry of Public Works and Environment and which has more than 15 years of experience in the design, construction and development of Athenian Metro, undertook – in December of 2003 – the realization of that complex project.

Before the final bidding, the organization (AM) spotted and redesigned a number of essential points in the initial plans and blueprints of the work, which aimed to improve the quality of the final result and also to redress technical issues which could lead to severe time delays during the construction phase.

Picture 4.1: Map of Thessaloniki where is mentioned the route of Metro. [www.ametro.gr]

The final contract was signed in the April of 2006; the preconstruction works are taking place on the worksites now, together with other preparatory works (bypass of the utilities' networks, archaeological excavation, geotechnical monitoring, recording of the static situation of the buildings which are founded above the Metro line, supplementary technical studies etc). At this point, the signed contract includes the works for the first phase of the project, whose major technical characteristics include:

- 13 modern stations with 60m central platforms and automatic gates on them – mainly for safety reasons, but also the ability to air condition them (the prospective result will be similar to the new stations of Jubilee line in London tube).
- 9.6 km of rail lines comprised by two individual single route tunnels, where the biggest part of them (7.7 km) will be constructed by two Tunnel Boring Machines (TBMs) and the rest with the 'cover-and-cut' method.
- 18 super-automatic, state of the art trains, fully air-conditioned with minimum capacity of 450 persons. More than their aerodynamic design, for safety reasons, they will be equipped with CCTV (close

circuit TV) and a system for direct communication between the on-board passengers and the operational centre of the network. Moreover, trains will operate automatically, without drivers.

- Construction of a major train depot in the region of Pilea (Votsi) with a total occupied surface of ~50,000 sqm
- Approximately 20,000 sqm of archaeological excavation in cooperation with the Ministry of Culture.

Although that the first phase of the works has not finished yet, it has already been decided which will be the next phases and the expansions of the network. Therefore, in the signed contract, Attiko Metro has already embodied the necessary technical works (M&E, structural, railway) which should be completed for the first two metro lines' expansions. In this way, the works for the aforementioned expansions can take place any time without causing disruption to the operation of the rest of the network.

The total budget of the project (first phase), including the cost of the main contract, preparatory works, supervision and management towers to 1.1 billion euros.
It is estimated that 3000 persons will work on the project, including those who will work for the contractor, subcontractors or suppliers.

According to the time schedule (and if critical contingencies are not issued), the project will finish 6.5 years after the starting date (almost 5 years from now).

Of course, as commonly happens in projects of this size and complexity, there are many players and roles within the venture. Specifically in TMP the key-roles have been taken by the players below:

Sponsor:

The project is sponsored by the Greek government (Ministry of Environment, Land Planning and Public Works) and it is co-funded by the European Regional Development Fund.

Design, bidding and project management:

Attiko Metro: the company that was responsible for the construction of Athens' Metro. Attiko Metro operates in the name of Greek government and has probably the most important role in the project. Attiko Metro redesigned the project, organized and held the international bidding for the winner-contractor and finally it is supervising the construction of the project.

Contractor:

The contractor is a Joint Venture (JV) comprised by the following firms:

A.E.G.E.K. S.A.: One of the biggest construction companies in Greece and leader of the JV; its participation percentage is 28% of the whole project. It is also involved in the construction of 3 stations at Athens' metro and it is regarded as one of the most experienced in projects of that size in general, and especially in metro construction.

IMPREGILO: Major Italian construction firm with a great tradition in railway projects. It participates also in the construction of Naples and Genoa subway.

ANSALDO TSF: Italian company which is specialized in railway and subway projects. Ansaldo took part in the construction of Copenhagen subway.

SELI: SELI since 1950 is working in the TBM tunnelling industry and it is one of the most experienced worldwide. It took part in the construction of Athens' Metro.

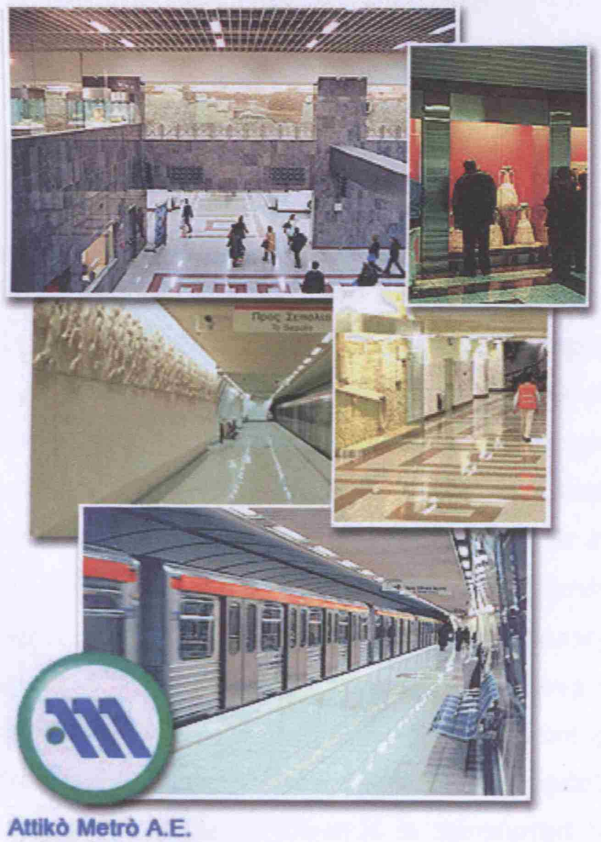
ANSALDOBREDA: Ansaldobreda S.P.A. is a company based in Naples, Italy and responsible for designing and manufacturing railway and mass transit vehicles.

Until now, Attiko Metro (AM) is the player that has been mainly activated; from the contractor's side only the preparatory works have started, and those have been undertaken from AEGEK, and the rest of the firms are going to engage with the project during its future phases. On the other hand, the role of the Greek government seems to be focused only on the sponsoring and any juristic matters, as for the

technical and consulting part the government has stand on AM. For all the reasons above plus our limitations in text size and capability to cover all that variety of different roles, our report will focus on the AM as the key-organization to develop and use KM and OL practices.

4.2 KM and OL Practices in Attiko Metro

It has been obvious from our extended anaphora of KM practices in the second chapter of this report, that those are dispersed almost in every organisational activity and things get worse because of the variety of views from various authors and theorists on these matters; so, it is highly risky to try to cover every given aspect of KM and the odds are that such a study will turn to an extremely generic text rather than to a research report.



Picture 4.2: Stations of Athens' Metro where antiquities are exposed [www.ametro.gr]

Relatively to Attiko Metro, our work will focus mainly on the creation and storage of knowledge (long-lasting involvement with metro works, great complexity of the project, and uniqueness of its kind in the Greek technical environment foster the

potentials for such practices) as also to the transfer of knowledge mainly between the two Greek metro projects and secondary from analogous projects all over the world.

1. *Transfer of knowledge from the international scene* (knowledge that was not created within the organization). All subway works are considered extremely complex and Athens' Metro was not an exclusion of that rule. AM stand in need of using three different methods of excavation for the tunnels and recalled every known – internationally- knowledge around these projects. Actually that was not mainly a paradigm of transferring knowledge, but a way to *gain knowledge;* transfer took place through an expert. AM during its first years of involvement with the works of metro, used *Bechtel* as key-consultant in financial, technical and other issues. Bechtel's long experience and knowledge helped AM to gain knowledge, which was recorded (see bullet 4) for future reuse.

2. *Transfer of the created-in-house knowledge.*
   a) AM relocated key-persons, with more than 10 years of experience in Athenian metro, to similar positions in Thessalonica's project. These people form the cores of extended networks of employees and beyond the direct exploitation of their K through their own work; they are able to transfer K to their colleagues both in the form of written reports and guidelines (explicit K), as also via personal contact in the work routine (subjects of tacit K).
   b) As Attiko Metro has completed 15 years in works of metro, it has confronted almost every kind of difficulties that could arise in the Greek technical environment and of course it has recorded the indicated solutions. Those practices are transferred to the rest of the Greek and international technical community through a number of articles which are published in relevant magazines and websites. Moreover, for practices of high complexity or issues of tacit knowledge, AM organizes in defined periods of time seminars where the aforementioned K is transferred from its experts or finally, people from the organization participate to seminars, forums and meetings which are held from other organizations or public authorities.
   c) Fixed meetings are kept in daily basis among the employees of AM. Those meetings may be among working teams with different specialty, who work in correlated parts of the project (e.g. Civil

engineers with M&E engineers who work in the same station), or even employees with the same technical background who work in different parts of the project in terms of location or time (eg. Tunnel engineers who work in different tunnels).

3. *Transfer of knowledge that was created in-house and 'extramural'.* In addition to the above, orderly meetings are held also between working teams of AM and technicians or managers of other organizations or authorities which are involved in the project (e.g. meetings with the people of the local authorities or the utilities companies).

4. *Recording and Storage of Knowledge.* Every single technical work is being recorded. Initially, that happens by the contractor (or the subcontractor) and then the recording's content is verified by the AM engineers who are supervising those works. In daily basis, that takes place on the site, in the 'Work Books' (what is known as 'Log Books' in UK). In monthly basis, supervising and design engineers repeat recording in detail. These files are part of the contractor's monthly accounts and they are segmented in different volumes. Advanced technical issues (e.g. those which relate with TBMs) are analyzed in detail by specialized engineers. In sequence, that knowledge is accessible for every engineer of AM or even university students who study relevant subjects.

5. *Intranet.* AM has developed an intranet since 2002 which is fully accessible to everyone in the organization. Firstly, the system portrays the structure of the organization. It has a complete list of every person who works for the company together with his/her position in the firm and their contact details. Secondly, there is a list of links to websites relevant with the project. Those sites may be owned by the companies which comprise the JV, Governmental or EU authorities who are involved with the projects and other potential participants. Moreover, there are all the press releases of AM and of course there are technical and other information and data about the projects themselves (Athens's Metro and TM). Finally, employees can find information or announcements, relevant to them, from their syndicate or other sources.

6. *Documentum.* AM is using a software platform, provided by EMC, for the management of content across multiple departments within

a single repository. *This unified, comprehensive, and scalable platform ensures content authenticity and integrity, simplifies management with automated policies, enables content sharing across the organization, and assigns the right level of protection to the right information at the right cost* (www.emc.com). Documentum is updated in daily basis with new information and elements about the project. Additionally, documentum supports a search engine where every person who works in the company can search for the aspects he is interested in by key-words; the system will bring to light all the relevant mail between AM and the subcontractors or other participants in the project about the subject of research. Of course then the interested person can study at those information and read down solutions that were used in similar situations.

Intranet and Documentum were put in place in 2002 and in 5 years time, they have more than 750,000 hits from AM employees

7. *Training programme of AM.* AM as a part of its efforts for continuous learning of its people, it 'runs' a special training programme for its employees. During the last two years almost the 90% of its personnel has attended around 420 specialised training programmes which are getting updated and enriched with new and upcoming subjects in the specific industry, for example 'quality certification' and 'quality control'.

As part of our study on the Attiko Metro (AM) KM practices, it was eligible for us to evaluate them and measure their efficiency. For that reason, the view of AM people was asked through a sort questionnaire which was focused on their opinion about intranet, Documentum and training programme. Although, that our sample – 10 answered questionnaires - it is small for an organization with the size of AM, the fact that all the people who replied are working in different departments (dispersion), had a long working relationship with the company (11 years on average and only two under 10) and their final answers are similar authorize us to use the results as hue clues of the reality.

All the people of AM who answered the questionnaires are using both the intranet and the Documentum and moreover they do that quite often[2] . As for the training programmes, they all have attended more than one till now (3.3 on average, which equals with 3 programmes every ten years). These elements give extra weight on their opinion. Finally, they find intranet efficient enough (3.6/5), Documentum very efficient (4.4/5) and they are totally contented (4.9/5) by the training programmes of AM.

4.3 Application of Knowledge on the Design of the Project

Concluding, after the identification of KM practices in the organization, it would be useful to remind that KM is not 'an end in itself' for organizations, but a conscious strategic choice with anticipated results in their work. For a project based organisation like AM, the gained knowledge will prove its value only after its application on the projects or the business cycle. Although, this –usually- takes time, AM has already brought forth some tangible mistakes which it has imposed on the initial design of Thessaloniki Metro. Changes that arise from AM's gained knowledge include the following:

a) For the elimination of the public disturbance during the process of the works, AM decided not to use the 'cut and cover'[3] method that was used in Athens, and which proved to cause major traffic nuisance. But, in the contrary, the 'cover and cut' method which allows the bigger part of the works proceed underground without causing additional problems at the city's life on surface.

b) Because of the collection of new data about the ground soil of the city of Thessaloniki (knowledge that was transferred from governmental services or created after the usage of new methods for the analysis of soil) AM managed to define precisely the methods of excavation that it could be used for the whole project – according to the updated data; an issue that will help in the programming of the works and in economy of time.

[2] They were asked to evaluate the frequency of use in a scale of 1-5 – where 5 stands for very often use - and the averages were 3.7 for intranet and 3.5 for Documentum.

[3] By this method, a trench is excavated with ground support as necessary and the whole tunnel is constructed within this. The trench is then backfilled and the surface is reinstated. By employing the cover-and-cut method , the cover i.e. the roof of the structure is poured as soon as the walls have been inserted, thus permitting the surface above the cover to be used again while the subsequent driving work takes place underneath. (Obermeyor Planen+Beraten, 2005)

c) A critical issue for every major work – especially underground – in Greece is the proper manipulation of the ancient remnants that very often lie under the surface of modern cities. AM gained extremely valuable knowledge on such issues following the excavations for Athens's project. The organization primarily changed the initially designed routes of the metro in order to avoid as much as possible (according to our K about the ancient city of Thessaloniki) the remnants of antiquity. Furthermore, AM forwarded the procedures for cooperation with the Greek Ministry of Culture in order to expose – in future – the most representative of the findings in the main stations of the metro network (see pic.4.2). Following this way, they managed to transform a potential drawback to advantage.

d) Also, the aforementioned change in route, served the avoidance of Thessaloniki's main draining tube, which – according to the original technical study – should be relocated.

e) Finally, as AM recognizes the special role of Aristotle University of Thessaloniki (AUTh) in the life of the city, it agreed to redesign some design details especially for that case with main target to eliminate any disturbance for the operation of the foundation in general and its laboratories more specific during the period of works at university's region.

Analysis

5.1 Introduction

Following the theoretical framework which we analyzed in the second chapter and the case study that we introduced in the previous chapter, our next step will be a combination of them. Actually, our effort will be to relate the case study and more specifically the KM and OL practices with the theory which we analyze before. By these means we are achieving a kind of 'mutual completion' for the theoretical and practical part of our research. We gain a better understanding for the reasons and the scopes of the practices we described and also we are highlighting tangible examples of the theories we mentioned. Our analysis will follow the sequence of concepts that were reported in the literature review, in the same order as they were written in the relevant chapter in order to help the reader to follow it. We will use Dixon's criteria for the categorization of knowledge transfer practices, Nonaka's and Takeuchi's model of knowledge creation process, Argyris and Schön types of OL as also Morris' views for PBL opportunities.

As we saw in the previous chapter, AM uses a series of practices in order to cover equally matters of explicit or tacit knowledge. There is an extended use of solutions related to the recording, storage and diffusion of knowledge in form of documents and other types of texts. Log books, monthly accounts' books and reports on specialized issues, create a sum of means which include all the information generated during the construction process. The use of IT systems as it is Intranet

and mainly Documentum, ensures the diffusion of that knowledge (explicit) among employees. On the contrary, tacit knowledge can be transferred only through personal contact and face-to-face communication. AM's training programmes, the meetings of project teams and the relocation of key persons can leverage the transfer of tacit knowledge within the organization.

5.2 Knowledge Management Practices

The first and often the easiest way to implement KM in an organization is to exploit new technologies and IT systems. AM operates an intranet network, which gives the opportunity to retrieve explicit knowledge from sources which are inside and outside the organization. The frequency of use and the aforementioned answers at the questionnaires about its efficiency indicates that employees find it helpful and it is merely serving its scope. On the other hand, the potentials of an internal computer network are much greater than those which are exploited in AM, where the content of it is limited. Even more satisfied (according to the answers on our questionnaires) are the people of AM about the Documentum. That system enables 'Enterprising Content Management' (www.emc.com) and gives the opportunity for retrieval and transfer of documents from a big and updated data base. Finally, employees – mostly among those who work in the same project team – exchange documents and information via e-mail or memo system[4]. All the above point use of *codification* (Hansen and Ali, 1999) for the transfer of knowledge in the organization, but in reality, AM uses *personalization* (Hansen and Ali, 1999) as well.

AM is a project-based organization and for that reason is common for its employees – of course with an exception at the highest levels of hierarchy – to working in teams. Additionally, whenever it is needed, these teams are multidisciplinary and that element adds extra interest because there are bigger potentials for transfer of knowledge among people with different backgrounds. Moreover, working teams have meetings with people outside the team or even the company who are also engaged with the project. Those meetings are not part of a knowledge-related policy of the company and consequently there is not a fixed practice for every project team in AM. On the contrary, what happens more often is that a team, depending on the subject which has undertaken, schedule beforehand the number and the participants of the

[4] The information about the ways of communication among employees, as also some aspects of the AM routine which will be presented later, were taken from the interview with an engineer of Attiko Metro and for that reason some data may contain the subjectivity of personal view.

meetings which will follow; so, there is the contingency of obtaining absolute ignorance among teams from different departments of the organization about the work the others do. Finally, the fact that most of the offices in AM follow an open plan and the existence of a mentality among employees to share their knowledge[5] helps the spread of tacit knowledge within organization.

As for the concept of 'Subject Matter Experts' (SME), it does not exist in AM. Although that the company transferred key-persons, with more than ten years of experience, from its project in Athens to TMP their role is not similar to what is described as SME in the relevant literature. They function mainly as 'vehicles' which transfer knowledge from one project to another and also they have the eligible experience to organize a project team. According to Dixon's (1994) categorization of KM practices and the way that knowledge is transferred, the practice we mentioned above is a *Serial Transfer* (Dixon, 1994) of knowledge. Serial transfer is performed also by the employment of people who have gained a major technical experience from projects different to Metro. Dixon refers mainly to teams and not in individuals, but we know that project teams are created from people who bring needed skills and abilities to a project and after its completion, the team is disbanded and they move on the next one (LaBarre, 1997). Furthermore, *Near Transfer* of knowledge is also applied in the organization through the meetings of project teams which are working in different parts of the project. *Strategic Transfer* of knowledge was used the very first years of AM's engagement with the Athenian metro project, when the organization used Bechtel as its key consultant. Unfortunately, we did not manage to gather data in order to confirm or refute the use of *Far* or *Expert Transfer* of knowledge by AM.

5.3 OL and PBL

If we adopt the three types of OL that Argyris and Schön (1978) had introduced, then *Single-Loop Learning* occurs for sure in AM. We had already highlighted the changes in the design of TMP which were introduced even as a result of new knowledge (innovation, new data) that was retrieved by AM, or even as an effort to correct mistakes which had already occurred in Athens' project. The change of the excavation method from 'cut-and-cover' to 'cover-and-cut' is a perfect example of this process. AM chose in Athens the most common and convenient (for the engineers)

[5] The information was given by the interviewee

method for low-depth tunneling of 'cut-and-cover', but that resulted horrendous traffic problems. Greek cities in general and the two biggest (Athens and Thessaloniki) more specifically are notorious for their traffic conditions. AM without altering the core nature of its activities gain a lesson from Athens project and applied a better solution for TMP. As for the *Double-Loop Learning*, we have not found any data which indicates that AM revealed some intrinsic sources of potential errors and it proceed to its modification. On the other hand, the detection of such changes needs a continuous and long-lasting study of the organization in order to discriminate them and analyze the reasons which caused them; that work was not and could not be part of the present paper.

The next step of this research will be the analysis of OL practices with our view focused on the opportunities for PBL. Learning comes through the lessons we take and those lessons may spring from study, living experience or teaching. After all, the structure of AM as a project – based organization tones the opportunities for such lessons to be taken. For the evaluation of the way that AM is learning lessons from the project we will use Nonaka's and Takeuchi's Organizational Knowledge Creation Process.

The first step of the procedure is *Socialization*. According to the engineer's view (the one who was interviewed), the level of communication among employees is very good and that is not restricted within the boundaries of a working team, but includes also managers and people from other offices. There is cooperation and people are willing enough to share their knowledge with others. Of course, we must underline again that these information are based exclusively on the personal point of view of one employee and they should not be taken for granted. On the other hand, the design of offices as 'open plan' and the project based structure of the company which is in favor of creating project teams are characteristics which objectively enhance the atmosphere that was described by the interviewee. On the contrary, there is a lack of common places (e.g. café) and social type meetings - with the exception of a Christmas party – which would result better relationships among employees and they could also enforce the opportunities for the development of *communities of practice* (Wenger, 1998).

Because of the project's complexity there is a consecutive need for people from a great variety of specialties. All these people form multidisciplinary teams where a continuous exchange of knowledge takes place during their occupation with the

project. As it has already be mentioned, the means which are in use for that purpose are documents, IT systems, e-mail, memo, fax for explicit knowledge and face-to-face contact, group meetings or even phone calls for matters of tacit knowledge. *Externalization* stands mainly for the ability to transform tacit knowledge into explicit by taking the form of examples, stories or concepts.

Externalization is a mean for the organization to capture the knowledge which is created in the projects and codify it in order to be 'compatible' with the learning process; then it can be used as the content of lessons. As Nonaka and Takeuchi propose, organizations firstly have to create *systemic knowledge* and *systemize their ideas* and then *combine* and categorize knowledge in new concepts or even new knowledge. Once again, it will be reminded that AM store all the information from the projects and by its diffusion in the organization it gives employees the materiel to build 'systemic knowledge' through meetings, IT communication, networks etc.

The final step of Organizational Knowledge Creation Process is *Internalization*. AM after the creation of new knowledge, which originated from the projects and formed through the process that was described above, it forwards the knowledge to its people using practices of OL. The lessons are taught in seminars organized by AM or they are studied from texts (articles, studies) which are published by AM. Finally, the organization prepares summaries of projects which are given to new employees as a way to help them become part of the organization.

PBL is a very interesting concept that can be easier embraced by project based organizations than the rest. It is also banked on the main practices of KM and OL. Recalling its best practices as they were described by Brander-Löf, Hilger, André, Levene, Turner, Keegan and Crawford (see table 2.2), we can see that AM has put in place a number of them: systematic collection of learning on projects, periodic project review points, distinguishing between tacit and explicit knowledge, information management tools - to capture, store, process, archive, retrieve and present explicit knowledge), training and individuals competencies development. The upcoming challenge for the organizations in their effort to achieve PBL is to recognize and identify the opportunities for PBL. Adopting the relevant figure (fig 5.1) from Morris (1988) which depicts these opportunities on a typical project, we can make a first-level analysis about the potential opportunities which AM has already recognized – without being in place to know if that happens as the result of a strategy aimed on PBL or it was an adjacent action.

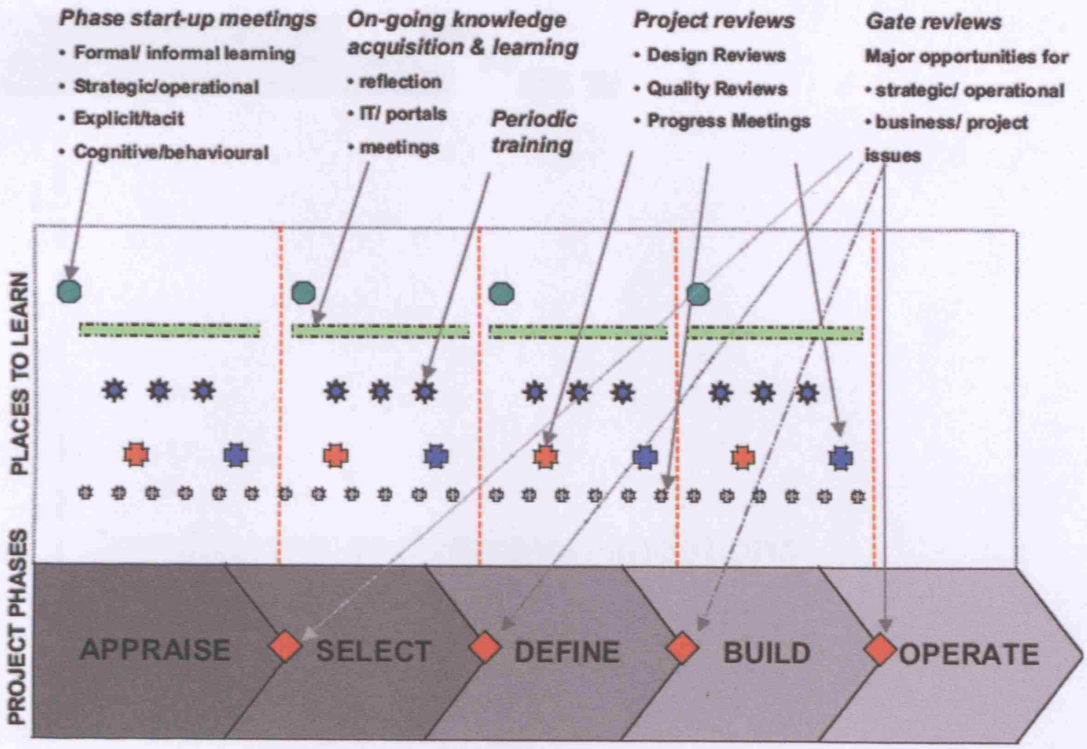


Figure 5.1: PBL opportunities in the life cycle of a project [Morris and Loch, 2002]

From the beginning of project's life cycle AM defines explicit and tacit knowledge, later implements IT systems and meetings, organize and support periodic training of its people and reviewing project phases in terms of quality, design, time and cost.

The final part of our analysis should be the evaluation of AM as a LO. The theoretical framework for that analysis would be Senge's 5 disciplines, but the data which could answer in which grade those disciplines are met in AM is unknown to us and consequently it is not possible to document an academic acceptable opinion.
In general, our data was focused mainly on the KM and OL practices and it helped to present the picture of the organization about those issues. Furthermore, the data that would treat with LO should cover issues of organizational culture, personal beliefs and mental models; obviously a research of that extension could not be part of this report.

Conclusions and Recommendations

6.1 Conclusions

The anteceded analysis in the chapter 5 will be utilized for the production of our conclusions and our recommendations about the weaknesses which were spotted. Our proposals are based equally on the data that was retrieved and the literature sources on KM theory and practices. Of course the drawn conclusions reach till the point where the research stopped, although that the nature of the problem is fertile for further analysis and development of detailed suggestions.

Proceeding to an overview about the KM in AM, it become clear that the organization has implemented a number of KM and OL practices, it has also gained lessons and after all it has managed to exploit a part of the knowledge which is generated or manipulated during the projects. The acquiring of knowledge by AM forms a competitive advantage for the company which was fully exploited when it came for the offering of the key-role at the construction of TMP. Although that is well-known that there are not other companies able to undertake this project in Greece, the example is still valuable as a project of that scale attracts companies from abroad as well. Additionally, we ascertained that AM was in position to exploit the gained knowledge and transform it into lessons which helped her to solve problems and improved its practices. The application of new ideas (changes in TMP design), the avoidance of mistake repetition (change of the excavation method) and the transfer of a good practice (management and treatment of the ancient findings) are examples

of the benefits which arise after the right implementation of KM (Collison and Parcel, 2000).

As it was shown, AM has introduced IT systems, group meetings, ways of storing valuable data, training programmes and other KM practices as well; moreover, the earnings of this implementation were just mentioned in the previous paragraph. However, the image of the organization is not perfect as much as it concerns the successful use of all these KM practices.

Intranet, according to the interviewee and its content - which was presented in chapter 4 – has restricted abilities (in comparison with a contemporary computer network) and it is possible to be demoted to a system of information management with its potentials never to be explored. Although that the evaluation of the system by the organization would probably point the problem, the lack of it makes things worse and it leads us to conclude that the problem may occur from the choices or the 'no choices' of the directors. The lack of evaluation causes a negative chain reaction at the efforts of AM to manage knowledge. It reduces the opportunities to design and organize the actions of the firm. Now, good practices may merely stultify as they are functioning randomly and moreover the people of AM are not encouraged to participate in any KM scheme, as these are not organized. The company seems to suffer from two of what Dixon had referred as common *myths*. The first myth stands for the assumption that managers often built an IT system in an organization and wait its people to support it. Experience showed that employees are disinclined to support and use such a system if there is not a kind of award. The second myth is the managers' belief that a learning culture is a prerequisite for the transfer of knowledge among employees. Reality has disproved that, as people are eager to exchange knowledge when there is a *serious task to be settled*. Summarizing, we conclude that there is a define need for the organization's leadership to organize better the KM practices and motivate people to support them.

> Each organization running projects has its own characteristics. Each has to build its own LO system. Buying some off-the-shelf software or training methods is unlikely to be sufficient, even though they might form the backbone of a LO architecture. Being conscious of the specificity of projects and being clear on the underlying assumptions of the concepts, methods, tools and techniques available, should, however, certainly help in the design of an appropriate system. (Morris, 2004)

The development of customized *good practices* in AM can be achieved by the application of the *holistic model of OL* by Collison and Parcell. The organization should motivate all its strengths and introduce benchmarks in order to turn practices measurable. The dependence of practices on a specific scope, the definition of expected results and the evaluation of those practices when they would be in place will accommodate their management. If AM choose that solution then the examination of training programs, enrichment of weak systems or the cancellation of ineffectual methods will become handy.

AM should also invest in people and the growing of *socialization* into the organization. The building of trust among employees, managers and directors, the support of social meetings and finally giving incentives for socialization to employees would boost the official and unofficial communication among the people and it would cultivate the diffusion of tacit knowledge.

Last but not least, the organization should support the continuous learning by projects. It is important to continue gathering information from a project even after the end of its construction. For the case of AM, the company should be interested in the opinion of end users even if any problems that may occur now are not its responsibility. The organization may continue gaining lessons, for example through the detection of a problem which originates from a technical fault or which can be solved, improved by the application of new techniques that were inspired during the operation of the project.

6.3 Propositions for Further Work

The concept, the project and the organization can implant a number of proposals for potential research depending on which level the researcher wants to work. Some suggestions which may start after the end of the present report, analyze further this subject or even be in parallel routes with that paper are mentioned below:

- A study research for the essential/proposed strategic choices that should be followed in order to turn AM into a LO.
- Further research and deeper analysis of the subject. Gathering of data for non-measurable aspects.
- The management of knowledge in the project. An inter-organization view, which would involve all the companies which take place and it could valuate the differences between firms with different characteristics.

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www.ametro.gr – official website of Attiko Metro S.A.

APPENDIX

Questionnaires

This section presents the version of the questionnaires that were developed to:

i) evaluate the efficiency of Intranet, Documentum and training programs

ii) guide the semi-structured interview with the engineer of AM

Questionnaire (i)

1. How long are you working in Attiko Metro?
2. Which is your position/role within the organization?
3. Have you ever used the intranet of AM?
4. If yes, could you please mention in a 1-5 scale, how often that happens? [1: rare, 5: often]
5. If not, why?
6. Have you ever used the organized database (documentum) of AM?
7. If yes, could you please mention in a 1-5 scale, how often that happens? [1: rare, 5: often]
8. If not, why?
9. Have you attended at any training programme of AM?
10. If yes, how many?
11. Can you rate, in a 1-5 scale [1: not effectively, 5: extremely effectively], how effectively are the systems we mention below:

i) Intranet, (ii) Documentum, (iii) training programs

12. What do you think it should change in order to improve the above systems? (Comments/Recommendations)

Questionnaire (ii)

About the first contact with the company – employment

1. Is there any kind of introductive training?
2. Is there any information about past projects of the company?
3. Is there any information about the way the organization operates? (Common procedures/particular customs of AM/culture of the organization)
4. Are there any stories/experiences which are spread among employees and indicate the possible differentiation of the organization?

About matters of socialization

1. Does the company motivate or support the social copulation of employees? (existence of common rooms, cafes, dining rooms, libraries/ organized social events)
2. How would you characterize the working environment of AM?
3. How is organized the working space in AM?

About the organizational structure

1. How is the firm structured?
2. How strict is the hierarchy of the organization?
3. Which is the role of project-teams in the firm?

About evaluation/correction of errors

1. Is there any program for the evaluation of past projects?
2. How does the firm review running projects?
3. Do the directors ask employees' opinion about the operation of AM?
4. Are you familiar with the evolution of the company? (Now and then)

Recording of knowledge/experience

1. Are there Log Books or other means for the recording of information on site?
2. Which practices do you know about the recording of information?

3. Are these 'information banks' accessible to engineers?

About the ways employees communicate within organization

1. Which are the most common ways of communication within the organization?
2. Which means are in use for the communication between the office and the site?
3. Which is your personal opinion about the extended use of electronic means for communication reasons? (e-mail/memo/forum)